HSF Working Group on Physics Generators

Common forum for:

- **Discussion** on the physics event generators used by **N**HEP experiments.
- **Technical work** on these physics event generators

Promotes collaboration among:

- Experimental physicists from NHEP experiments
- Theoretical physicists from generator teams
- Software and computing engineers

To:

- Improve the current source codes and production workflows.
- Making new theoretical advances easier to implement in a computationally efficient way.

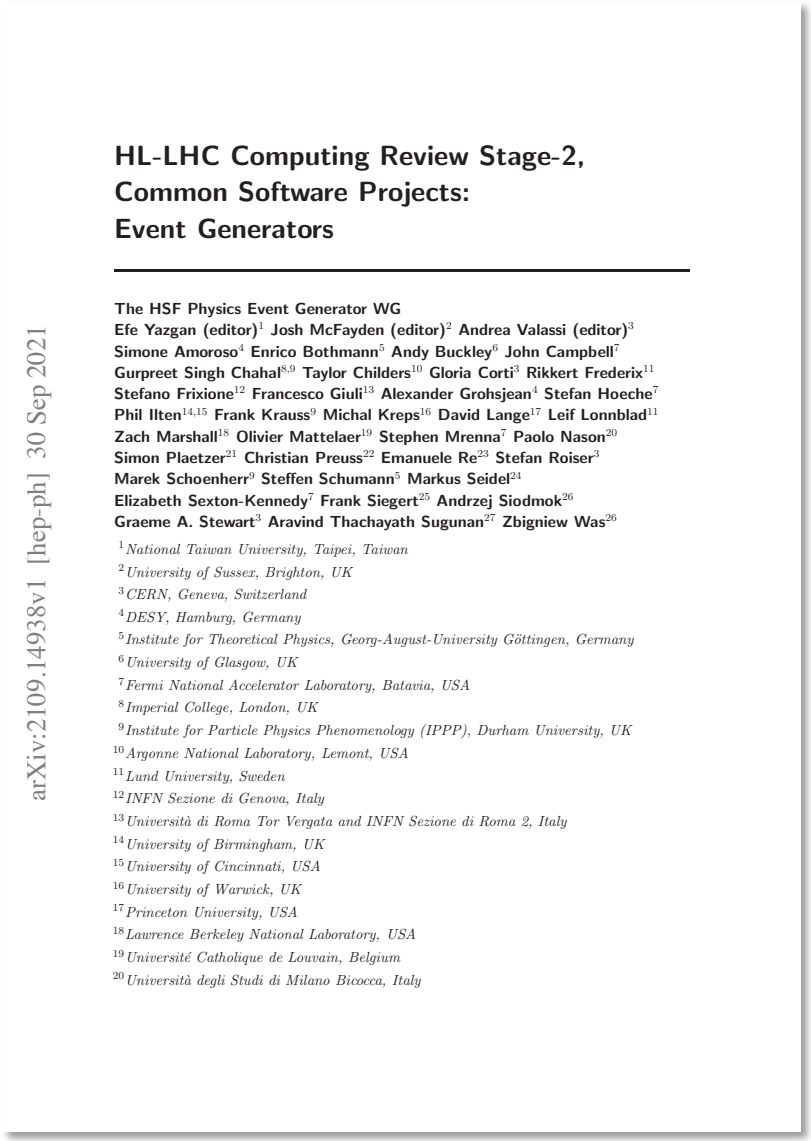
Conveners:

- Markus Diefenthaler, EIC and Jefferson Lab
- Efe Yazgan, CMS and National Taiwan University
- Josh McFayden, ATLAS and University of Sussex


hsf-generator-wg@googlegroups.com


https://hepsoftwarefoundation.org/workinggroups/generators.html

Recent Activities



HL-LHC Computing Review Stage-2, Common Software Projects: Event Generators

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"Challenges in Monte Carlo Event Generator Software for High-Luminosity LHC" (arXiv:2004.13687) published in Computing and Software for Big Science **5**, 12 (2021).

HL-LHC Computing Review on Event Generators

Performance benchmarking:

- Comparison between experiments.
- Comparison between generators.
- Efficiency savings, e.g., negative weights
- Section prepared for Snowmass White Paper on Event Generators

Plans for 2022 (and beyond)

- **Engage with other communities**
  - MCEGs for the EIC and NP
    - **MC4EIC**
  - MCEGs for neutrino experiments

- **Heterogenous architectures, in particular future HPC systems**
  - Ongoing work in MG4GPU and Sherpa
  - Feasibility for modular MCEG framework with GPU support

- **Accelerate event generators**
  - Continue work on benchmarking
  - **AI/ML**: What is useful for NHEP experiments?

- **Promote collaboration, training, funding and career opportunities for MCEG R&D**

Current Activities: Snowmass White Paper on Event Generators

- **Sec. 2: Cross-Cutting Physics and Technical Aspects (Elke, Markus, Tim)**
  - EIC contributes to: Factorization and parton evolution, Hadronization models, Multiple scattering and rescattering effects
  - Summary: Frontier accelerator facility for precision study of the nucleon and nuclei at the scale of sea quarks and gluons; multi-dimensional distributions
- **Sec. 6: Electron-Ion Collider (Elke, Markus, Tim)**
  - EIC Science Overview: Precision studies of non-pQCD and transition region to pQCD
  - Connection to HEP, including relationship to TeV-scale and neutrino measurements
  - EIC Status
  - Summary of EIC Simulations for Yellow Report and Detector Collaboration Proposals
    - General-Purpose MCEGs for the EIC and validation using Rivet
    - Community MCEG: BeAGLE, Sartre, lAGER, (...)
  - Required MCEG R&D for the EIC:
    - Spin-dependent parton shower and hadronization models
    - Simulation of eA
  - Theory for MCEG R&D:
    - Factorization and parton evolution (MC4EIC)
    - Hadronization models (MC4EIC)
    - Multiple scattering and rescattering effects (MC4EIC)
  - Ongoing MCEG R&D for the EIC:
    - Benchmark studies for eA simulations in BeAGLE
    - Lund string for eA
    - JETSCAPE?
    - ePIC
    - lAGER for mass studies
    - Simulation studies saturation physics in SARTRE
    - Comparison to theory: Unfolding vs. folding
  - Connection to other ep experiments: HERA, LHeC